Instructor: Prof. Anthony Várilly-Alvarado
Office: 222 Herman Brown
Email: varilly@rice.edu
Time: MWF 11:00-11:50AM
Classroom: Herman Brown 453
Office Hours: TBA
Class Webpage: Look for `Math 464 001 Sp13` on Owlspace.

Teaching Assistant: Letao Zhang.

Prerequisites: Math 463/563 or permission of the instructor.

Texts:
Introduction to Commutative Algebra, Atiyah & MacDonald (required).
Commutative Algebra with a view toward Algebraic Geometry, David Eisenbud (recommended).
Basic Homological Algebra, Scott Osborne (recommended).

Homework: Due once a week, on **Wednesdays, at the beginning of lecture**.

The homework is not pledged and you can collaborate with other students in the class. In fact, you are very much encouraged to do so. However, you are not allowed to look up solutions in any written form; in particular, you are not allowed to look up solutions online. You should write up your solutions individually.

Undergraduates enrolled in Math 464 will have a reduced homework load. Mathematics graduate students should enroll in Math 564.

This is a very important component of the course. This class has a heavy workload, and you should expect to spend a lot of time doing homework. Math 464/564 is in many ways similar to a language course: you must get lots of hands-on practice to internalize the definitions.

Exams: There will be a take-home midterm exam, due the week of **February 20th**. There will also be a 5-hour take-home exam, due during Exam period no earlier than the Registrar's Office scheduled final exam for the course, as per University Policy.

> **Warning:** It is the policy of the Mathematics Department that no final may be given early to accomodate student travel plans. If you make travel plans that later turn out to conflict with the scheduled exam, then it is your responsibility to either reschedule your travel plans or take a zero in the final.

If an exam conflicts with a holiday you observe, please let me know.

Grades: Homework will count for 50% of your final grade. The midterm will count for 20% of your grade and the final exam will count for 30% of your grade.

Attendance: Attendance is not required. However, you are responsible for all the material and announcements covered in lecture. While Owlspace is a valuable resource, not all announcements will be posted there. Nevertheless, you are responsible for reading any emails I send to the class through Owlspace.

Expectations: In my experience as a student, most people do not follow all the details of a Math lecture in real time. During lecture, you should expect to witness the big picture of what's going on. You should pay attention to the lecturer's advice on what is important and what isn't. A lecturer spends a long time thinking on how to deliver a presentation of an immense amount of material; they do not expect you to follow every step, but they do expect you to go home and fill in the gaps in your understanding. Not attending lecture really hurts your chances at a deep understanding of the material.

Disability Support: Any student with a documented disability seeking academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All such discussions will remain as confidential as possible. Students with disabilities will need to also contact Disability Support Services in the Allen Center.

Topics to be covered

1. **Rudiments of Category theory:** Definitions, examples. Equivalences of categories. Adjoint functors. Representable functors and the Yoneda Lemma. Products, coproducts, fibered products. Universal properties. Limits.

2. **Commutative Algebra:** Some ideal theory beyond Math 463. Tensor and exterior algebra. Flat, free and projective modules. Localization. Gröbner Bases. Integrality. Chain conditions. Noetherian and Artinian rings. Dedekind domains.

3. **Further Galois Theory:** Inverse limits; infinite Galois theory.

4. **Rudimentary Algebraic Geometry:** The category of affine schemes. Hilbert Nullstellensatz.

5. **Homological Algebra:** Complexes; homology. Injective modules and derived functors. Ext and Tor. Time permitting: the Koszul complex.

Rather than compartmentalize the topics as above, I will blend some of the material together, mostly for pedagogical reasons.